REMARKS

Applicant concurrently files herewith an excess claim fee for (2) two dependent and (2) two independent claims.

Claims 13-18 and 19-34 are all claims presently pending in the application. Claims 1-12 have been canceled and new claims 19-34 have been added to more particularly define the invention. By this Amendment, reconsideration is respectfully requested. Claims 13, 14, and 16 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Roberts & Caserio, Basic Principles of Organic Chemistry, 2nd May 10, 2002, 1977, p. 1505 (hereinafter "Roberts"). Claims 13 and 14 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Yokogawa, et al. (U.S. Patent No. 6,228,498). Claims 13-18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over Thess, et al., "Crystalline Ropes of Metallic Carbon Nanotubes," in Science, vol. 273, pp. 483-487, July 26, 1996 (hereinafter "Thess").

These rejections are respectfully traversed in view of the following discussion.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Attached hereto is a marked-up version of the changes made to the specification and/or claims by the current Amendment. The attached page is captioned "**VERSIONS WITH MARKINGS TO SHOW CHANGES MADE**".

It is noted that the amendments are made only to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by independent claim 13, is directed to a laser irradiation target. The laser irradiation target includes a fullerene and a catalyst. The catalyst associated with the fullerene. (See Page 4, line 15- Page 5, line 2; Page 8, lines 1-6 and 13-26).

Conventional targets are graphite carbon based materials suitable for producing multi-wall carbon nanotube structures at generally high temperatures. However, such conventional targets can only be used at high temperatures and with complex equipment. The present inventors have found that single-wall carbon nanotubes can be produced by laser ablation at lower process temperatures. (See Application at Page 1, line 25-Page 2, line 3; Page 2, lines 20-22 and 26-29; and Page 3, lines 11-30).

The claimed invention, however, includes a fullerene and a catalyst. As a result of this inventive structure, a single wall carbon nanotube can be produced at low process temperatures using a short pulse-width laser ablation method.

II. THE 35 USC §112, SECOND PARAGRAPH, REJECTION

Claims 13-18 stand rejected under 35 U.S.C. §112, second paragraph, for indefiniteness. Applicant notes, however, that these claims have been amended to overcome these rejections. In particular, Applicant has deleted the questionable terms when writing the claims to more particularly define the invention.

In view of the foregoing, the Examiner is respectfully requested to withdraw this rejection.

III. THE PRIOR ART REJECTIONS

A. The 35 USC § 102(b) Rejection Based on Roberts

The Examiner alleges that Roberts teaches the claimed invention. Applicant submits, however, that there are elements of the claimed invention which are neither taught nor suggested by Roberts.

As noted above, the inventive laser irradiation target includes a fullerene and a catalyst associated with the fullerene.

In contrast, Roberts only discloses metallocene componds with simple cyclopentene rings, i.e., cyclopentadienyl rings, and in particular a ferrocene compound with "two cyclopentadiene anions and ferrous ion with two C-Fe bonds" in a "sandwich" structure. (Roberts at Page 1505).

Clearly, Applicant's invention of a laser irradiation target includes a fullerene with a a plurality of 5-membered carbon rings and a plurality of 6-membered carbon rings in a substantially hollow truncated-icosahedron geometric shape with a substantially curved surface not two cyclopentadiene anions and ferrous ion in a sandwich structure as with the metallocene compound cited in Roberts. Further, Applicant's invention includes a catalyst physically associated with the fullerene to form the laser irradiation target whereas no catalyst is associated with the two five membered carbon ring of the metallocene compound. In addition, the reactant used to form the metallocene compound contains a MgBr molecule chemically bonded to the cyclopentadiene to form a cyclopentadienylmagnesium bromide whereas Applicant's catalyst is physically associated with the fullerene. Therefore, Applicant's invention, and resultant product, could not likely be produced using the metallocene compound structure cited in the Office Action.

Further, Roberts has nothing to do with "laser irradiation targets" as in the claimed invention.

For at least the reasons outlined above, Applicant respectfully submits that Roberts does not disclose, teach or suggest each and every element of the claimed invention. Withdrawal of this rejection is respectfully requested.

B. The 35 USC § 102(e) Rejection Based on Yokogawa, et al.

The Examiner alleges that Yokogawa, et al. ("Yokogawa") teaches the claimed invention. Applicant submits, however, that there are elements of the claimed invention which are neither taught nor suggested by Yokogawa.

As noted above, the inventive laser irradiation target includes a fullerene and a catalyst associated with the fullerene.

In contrast, Yokogawa only recites a structured body of carbon having a frustrum-formed protrusion formed from a top flat consisting of a single carbon pentagon and a lateral surface consisting of a plurality of carbon hexagons. The structured body of carbon is prepared by a two-stage heat treatment of a carbonaceous material having a carbon pentagon to form a crystalline structure, such as a fullerene compound. The first stage heat treatment is conducted at 800 °C to 1200°C to effect complete degradation of the crystalline structure of the starting material into an amorphous state and the second stage heat treatment is conducted at 1800 to 2500°C to effect re-crystallization but not to cause graphitization. (See Yokogawa at Abstract).

Clearly, Applicant's invention of a laser irradiation target includes a catalyst. Yokogawa, on the other hand, does not disclose any catalyst alone, or in combination with the fullerene. Indeed, Yokogowa has nothing to do with laser irradiation or forming carbon

nanotubes which is the purpose of the claimed invention.

For at least the reasons outlined above, Applicant respectfully submits that Yokogawa does not disclose, teach or suggest all the features of claim 13. Accordingly, Yokogawa does not anticipate or render obvious the subject matter of claim 13 and related dependent claims 14-18. Withdrawal of the rejection of claim 13, and related claims 14-18, under 35 U.S.C. § 102(b) as anticipated by Yokogawa is respectfully requested.

For the reasons stated above, the claimed invention is fully patentable over the cited reference.

C. The 35 USC § 102(b) and § 103 Rejection Based on Thess, et al.

The Examiner alleges that Thess, et al. ("Thess") teaches the claimed invention. Applicant submits, however, that there are elements of the claimed invention which are neither taught nor suggested by Thess.

As noted above, the inventive laser irradiation target includes a fullerene and a catalyst associated with the fullerene.

In contrast, Thess only recites laser vaporization of a carbon (graphite)-nickel-cobalt mixture at 1200°C to produce single-wall nanotubes. (See Thess at Abstract, Page 483, i.e., page 1). In particular, "samples were prepared by laser vaporization of graphite rods doped with 1.2 at.% of a 50/50 mixture of Co and Ni powder (~1 micrometer particle size) at 1200°C in flowing argon at 500 Torr, followed by heat treatment in vacuum at 1000°C to sublime out C_{60} and other small fullerenes. (See Thess, Page 487, i.e., Page 6, Column 1, References and Notes Section, Note Number 7).

The claimed invention, on the other hand, does not use graphite rods. Instead, the claimed laser irradiation target includes a fullerene and a catalyst. As a result, a significant

advantage of using fullerene, a non-graphite structure, as a reactant instead of graphite rods is that Applicant's invention produces single wall carbon nanotube at low process temperatures, e.g., for exemplary purposes only in a range of 350-450°C, using a short pulse-width laser ablation method. However, the Thess invention uses graphite rods at 1100°C, or higher, fairly high process temperatures, to produce single wall fullerene nanotubes (SWNT) "[are produced] as an off-shoot of the process that otherwise produces C_{60} in high yield." (See Thess, Page 486, Column1, lines 25-30). Thus, the fullerenes, i.e., C_{60}, are a product of the reaction with SWNTs produced as a by product of the same reaction with Thess whereas the fullerenes are an initial reactant producing single wall carbon nanotubes as the primary product as disclosed in Applicant's invention.

For emphasis, Applicant's invention is a new teaching and not obvious over Thess as the Thess invention is an example of conventional art which recites a structurally different reaction target as discussed above for use at much higher process temperatures. In particular, as with Thess, "when graphite/metal materials are used for the laser irradiation target in the pulsed laser ablation, a high temperature process of 1100°C or higher becomes necessary. Yield decreases rapidly if the temperature becomes lower than 850°C, and the formation of bundles of the single-wall carbon nanotubes becomes impossible below 600°C." (See Application, Background Section, Page 1, lines 25-Page 2, lines 3). Accordingly, it would at least be necessary, but possibly not sufficient, to modify the Thess material to a non-graphite material, change the catalyst to a single element and reduce the process temperatures to attempt reproducing Applicant's invention and produce the resultant product. Thess clearly fails to disclose, teach or suggest any of these changes and, similarly, the Office Action does not specifically indicate where such motivation is found.

For at least the reasons outlined above, Applicant respectfully submits that Thess does not disclose, teach or suggest all the features of claim 13. Accordingly, Thess does not anticipate or render obvious the subject matter of claim 13. Withdrawal of the rejection of claims 13-18 under 35 U.S.C. § 102(b) as anticipated by Thess is respectfully requested.

Finally, for the above cited reasons, regarding claims 14-18, which depend from claim 13, these claims are patentable not only by virtue of its dependency from the independent claim but also by the additional limitations they recite.

For the reasons stated above, the claimed invention is fully patentable over the cited reference.

IV. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 13-34, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 7/12/02

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Claims 1-12 were canceled without prejudice or disclaimer.

The Claims were amended as follows:

13. (Amended) A laser irradiation target for the manufacture of carbon nanotubes by [means of] laser ablation, said target comprising:

a fullerene; and

a catalyst associated with said fullerene [including carbon molecules having 5-memberd carbon ring bonds].

14. (Amended) The [A] laser irradiation target [for the manufacture of carbon nanotubes] as claimed in claim 13, wherein said fullerene comprises a five-membered carbon ring [, including carbon molecules having fullerene bonds].

15. (Amended) The [A] laser irradiation target [for the manufacture of carbon nanotubes] as claimed in claim 13, wherein said fullerene comprises a C_{60} fullerene [molecules are used as the carbon molecules having 5-memberd carbon ring bonds].

16. (Amended) The [A] laser irradiation target [for the manufacture of carbon nanotubes] as claimed in claim 13, wherein said [the]catalyst is combined with said fullerene [are included in the laser irradiation target].

17. (Amended) The [A] laser irradiation target [for the manufacture of carbon nanotubes] as

claimed in claim 13, wherein said catalyst comprises one of [the catalysts include] Ni and [and/or] Co.

18. (Amended) The [A] laser irradiation target [for the manufacture of carbon nanotubes] as claimed in claim 17, wherein said laser irradiation target comprises [the total amount of the Ni and/or Co in the laser irradiation target is set] between 4.5 [at] % and 5.5 [at]% catalyst.